

**Proposed
TOTAL MAXIMUM DAILY LOAD (TMDL)**

**For
Fecal Coliforms**

**In
Fivemile Creek
(WBID 3578)**

Prepared by:

US EPA Region 4
61 Forsyth Street SW
Atlanta, Georgia 30303

September 2008



TABLE OF CONTENTS

1.	INTRODUCTION.....	1
2.	PROBLEM DEFINITION	2
3.	WATERSHED DESCRIPTION.....	3
4.	WATER QUALITY STANDARD AND TARGET IDENTIFICATION.....	5
5.	FECAL COLIFORM TMDL.....	5
5.1	WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET	5
5.2	SOURCE ASSESSMENT.....	7
5.2.1	<i>Point Sources</i>	8
5.2.2	<i>Nonpoint Sources</i>	10
5.3	Analytical Approach	12
5.4	Development of Total Maximum Daily Loads	13
5.4.1	<i>Critical Conditions and Seasonal Variation</i>	13
5.4.2	<i>Existing Conditions</i>	13
5.5	Margin of Safety.....	14
5.6.	Determination of TMDL, LA and WLA	14
5.6.3.	<i>Waste Load Allocation</i>	15
5.6.4.	<i>Load Allocation</i>	15
5.8.	Recommendations	15
	REFERENCES.....	17

LIST OF TABLES

Table 1. Land Cover Distribution for Fivemile Creek (WBID 3578).	3
Table 2. Monitoring Stations used in the development of the fecal coliform TMDL.	6
Table 3. Water Quality Statistics for Fecal Coliforms in Fivemile Creek (WBID 3578).	6
Table 4. Rainfall Totals Measured at the Gainesville Regional Airport.	7
Table 5. 2002 Agricultural Census Data for Livestock in Union County, FL.....	10
Table 6. Fecal Coliform Measurements in Fivemile Creek (WBID 3578).....	14
Table 7. Summary of TMDL Components for Fivemile Creek (WBID 3578).	14

LIST OF FIGURES

Figure 1. Location of WBID 3578 in the Santa Fe River Basin.	2
Figure 2. Landuse and location of sampling stations in the Fivemile Creek watershed.....	4
Figure 3. Fecal coliform data collected in Fivemile Creek (WBID 3578).	6

LIST OF ABBREVIATIONS

AWT	Advanced Waste Treatment
BMP	Best Management Practices
CAFO	Concentrated Animal Feeding Operation
CFS	Cubic Feet per Second
CFR	Code of Federal Regulations
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
HUC	Hydrologic Unit Code
IWR	Impaired Waters Rule
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer Systems
N/A	Not Applicable
NASS	National Agriculture Statistics Service
NLCD	National Land Cover Data
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OSTD	Onsite Sewer Treatment and Disposal Systems
PLRG	Pollutant Load Reduction Goal
SRWMD	Suwannee River Water Management District
STORET	STORage RETrieval database
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WBID	Water Body Identification
WLA	Waste Load Allocation
WMP	Water Management Plan
WMD	Water Management District
WQS	Water Quality Standards
WWTP	Wastewater Treatment Plant

SUMMARY SHEET

Total Maximum Daily Load (TMDL)

1. 303(d) Listed Waterbody Information

State: Florida

Major River Basin: Santa Fe River Basin (03110206)

Impaired Waterbodies for TMDLs (1998 303(d) List):

WBID	Segment Name and Type	River Basin	County	Constituent(s)
3578	Fivemile Creek	Santa Fe River	Union	Fecal Coliforms

2. TMDL Endpoint (i.e., Target)

Class III Waters (Fresh):

Fecal Coliforms:

400 MPN/100ml (10 percent of samples)

3. Fecal Coliform Allocations:

WBID	WLA ¹		LA (% Reduction) ²	TMDL (% Reduction) ²
	Facility (MPN/day)	MS4		
Fivemile Creek (WBID 3578)	N/A	N/A	15%	15%

Notes:

1. The WLA is typically separated into the components originating from continuous NPDES facilities (e.g. WWTPs) and from Municipal Separate Storm Sewer (MS4) areas. A WLA for NPDES facilities is not provided because there are no NPDES facilities currently discharging to the surface waters of Fivemile Creek (WBID 3578) or its tributaries. WBID 3578 is not currently affected by an MS4 permit, so the WLA for MS4 areas is also not applicable (N/A).
2. Overall percent reduction required to achieve the 400 MPN/100ml fecal coliform criterion. The Margin of Safety is implicit and does not take away from the TMDL value. See Section 5.6 for information about how to convert the TMDL to a daily load.

4. Endangered Species (yes or blank): Yes

5. EPA Lead on TMDL (EPA or blank): EPA

6. TMDL Considers Point Source, Nonpoint Source, or both: Nonpoint Source

7. Major NPDES Discharges to surface waters addressed in TMDLs: None

TOTAL MAXIMUM DAILY LOAD (TMDL) FOR FECAL COLIFORM IN FIVEMILE CREEK (WBID 3578)

1. INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to compile a list of those waters within its boundaries for which technology based effluent limitations are not sufficient to protect water quality. A waterbody that does not meet any water quality standard applicable to it due to the presence of one or more pollutants is considered “impaired”. States are required to prioritize 303(d)-listed waters (i.e. impaired waters) with respect to their designated use classifications and the severity of pollution, and then develop Total Maximum Daily Loads (TMDLs) for them consistent with this prioritization. TMDLs determine the allowable loadings of pollutants or other quantifiable parameters based on the relationship between pollution sources and water quality conditions in the waterbody. States can then establish water quality based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

The Florida Department of Environmental Protection (FDEP) developed a statewide approach to managing water resources on the basis of natural boundaries, such as river basins, rather than political boundaries. This watershed management approach is the framework FDEP uses for developing and implementing TMDLs. The state’s 52 basins are divided into five groups. Water quality is assessed in each group on a rotating five-year cycle. FDEP also established five Water Management Districts (WMD) responsible for managing ground and surface water supplies in the counties encompassing their districts. Fivemile Creek is a Group 1 waterbody located within the Suwannee River Water Management District (SRWMD).

For the purpose of planning and management, the WMDs divide their districts into planning units defined as either an individual primary tributary basin or a group of adjacent primary tributary basins with similar characteristics. Fivemile Creek is located within the Santa Fe River Planning Unit. Planning units contain smaller, hydrological based units called drainage basins, which are further divided into water segments. A water segment usually contains only one unique waterbody type (stream, lake, canal, etc.) and is about five square miles in area. Unique waterbody identification (WBIDs) numbers are assigned to each water segment. The Fivemile Creek segment addressed in this TMDL report is designated WBID 3578. The geographic location of Fivemile Creek is shown in Figure 1.

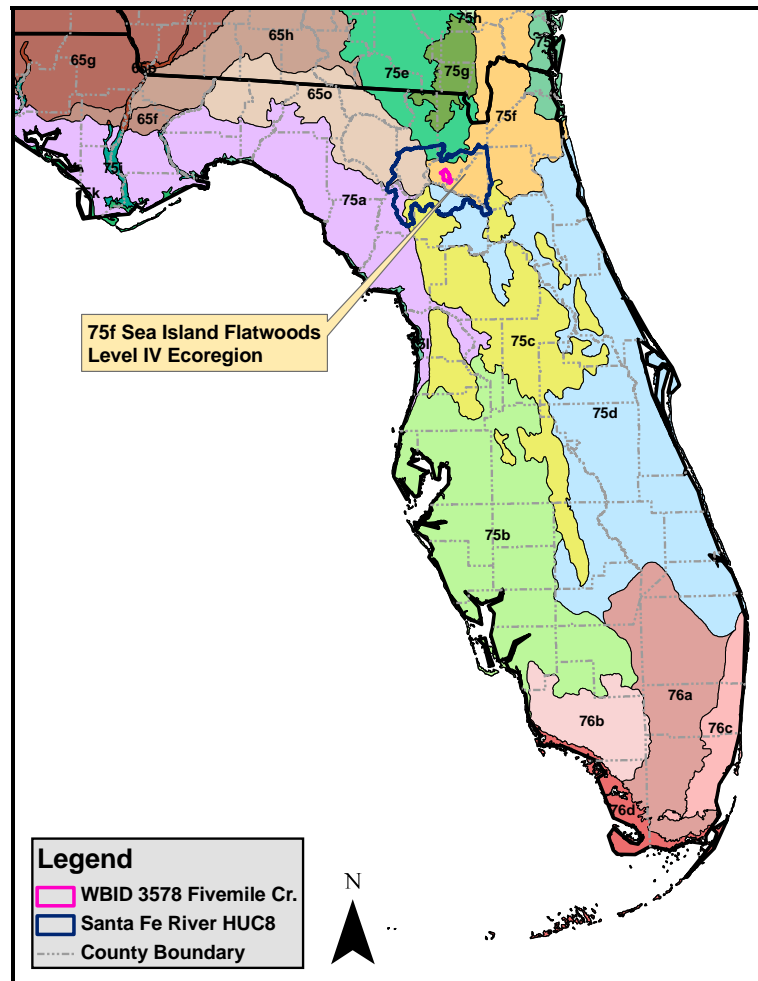


Figure 1. Location of WBID 3578 in the Santa Fe River Basin.

2. PROBLEM DEFINITION

To determine the status of surface water quality in the state of Florida, chemical data, biological data, and fish consumption advisories were evaluated for potential impairments. Florida's process for determining levels of water quality impairment is described in the Identification of Impaired Surface Waters Rule (IWR), in Section 62-303 of the Florida Administrative Code (F.A.C.). The IWR defines the threshold criteria for determining if a waterbody should be added to the state's planning list of potentially impaired waters. Once a waterbody is on the planning list, additional data and information will be collected and assessed to determine if the water should be included on the state's verified list of water quality impairments.

Florida's final 1998 Section 303(d) list identified Fivemile Creek (WBID 3578) as potentially not supporting water quality standards (WQS) related to nutrients, dissolved oxygen, and fecal coliforms. Fecal coliform bacteria are present in large numbers in the intestinal tracts of humans and

other warm-blooded animals. With the exception of *Escherichia Coli*, most fecal coliform bacteria do not cause disease by themselves. However, high numbers of them in a waterbody are used to indicate the presence of fecal material, and therefore the likely presence of other bacteria that are pathogenic. A 1998 Consent Decree in the Florida TMDL lawsuit (Florida Wildlife Federation, et al. v. Carol Browner, et al., Civil Action No. 4: 98CV356-WS, 1998) established a schedule by which EPA is committed to developing TMDLs. Since FDEP has not yet verified the fecal coliform impairment in Fivemile Creek (WBID 3578), EPA is responsible for assessing all readily available water quality data to determine whether a TMDL should be developed.

The format of the remainder of this report is as follows: Chapter 3 is a general description of the impaired watershed; Chapter 4 describes the water quality standards and target criteria; and Chapter 5 describes data and source assessments, as well as the approach used to develop the TMDL.

3. WATERSHED DESCRIPTION

Fivemile Creek (WBID 3578) drains approximately 40 km² of southern Union County in Florida. Fivemile Creek joins the New River not far upstream of its confluence with the Santa Fe River. The watershed is within the low-lying and poorly-drained Sea Island Flatwoods subcoregion (75f) of the Southern Coastal Plain (Figure 1). Native forest communities of this ecoregion include mixed forests of pines, oaks, beech, sweetgum, and southern magnolia trees. Like many streams in the Santa Fe watershed, Fivemile Creek is a blackwater stream characterized by acidic, highly colored water and low dissolved oxygen.

Approximately 45 percent of the landuse in the Fivemile Creek watershed remains as forest, and there are many wetland areas (19.3 percent) as well (see Table 1 and Figure 2). The 5.6 percent of the watershed used for residential developments is mostly comprised of fixed, single-family or mobile homes at a low density of less than two units per acre. Over one-quarter (26 percent) of the Fivemile Creek watershed is classified as agriculture, and the largest agricultural use is for improved pasture. There are no known Concentrated Animal Feeding Operations (CAFOs), Municipal Separate Storm Sewer System (MS4) permits or NPDES-permitted discharges in the watershed.

Table 1. Land Cover Distribution for Fivemile Creek (WBID 3578).

WBID 3578	Urban and Residential	Agriculture	Upland Nonforested	Forest	Water	Wetlands	Transportation & Utilities	Total
Square Kilometers	2.27	10.69	1.08	18.45	0.20	7.82	0.11	40.62
%	5.6%	26.3%	2.7%	45.4%	0.5%	19.3%	0.3%	100%

Notes: Areas represent the 2004 land use distribution in the impaired WBID and not the entire drainage. Upland nonforested category includes shrubland and rangeland.

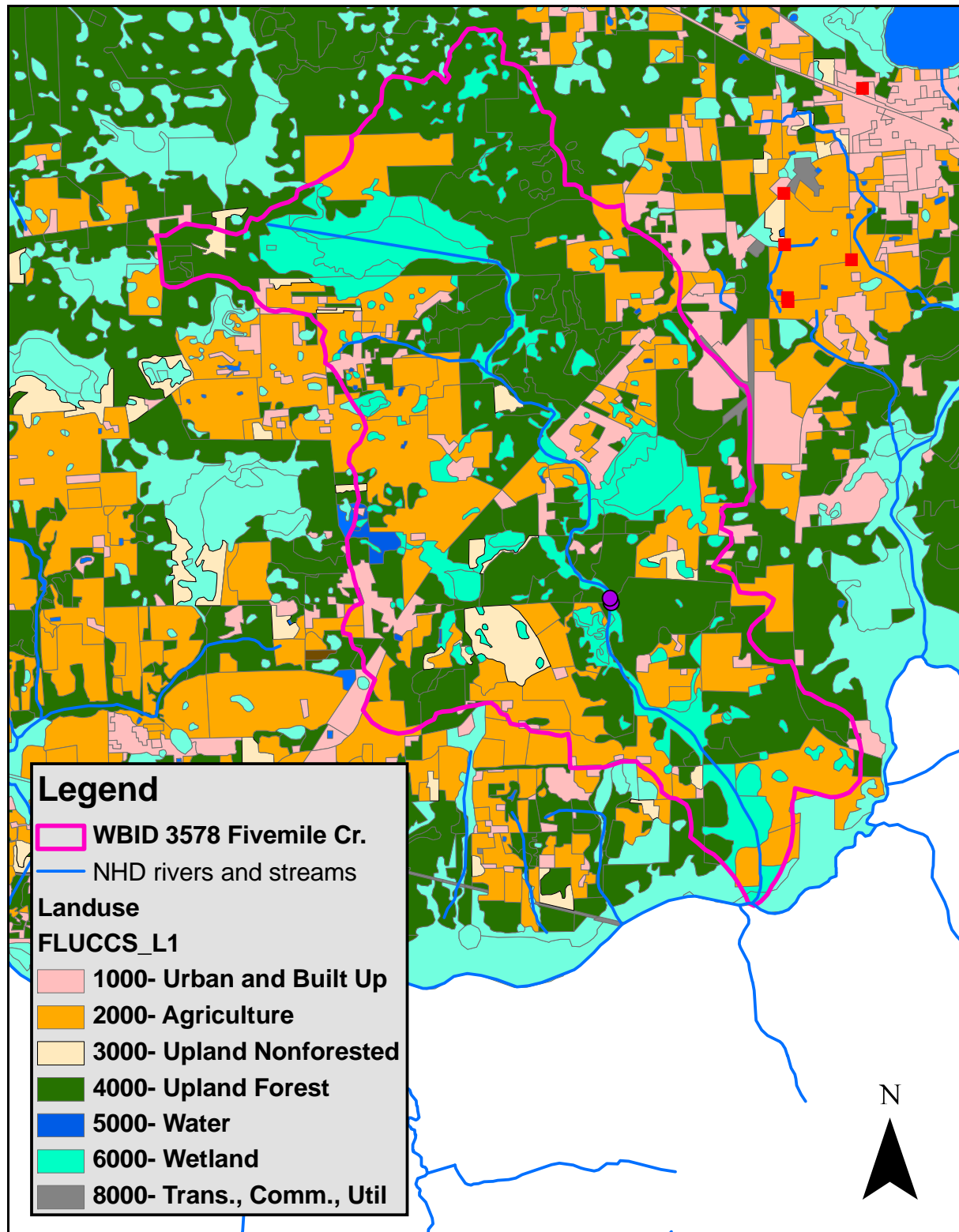


Figure 2. Landuse and location of sampling stations in the Fivemile Creek watershed.

4. WATER QUALITY STANDARD AND TARGET IDENTIFICATION

Fivemile Creek (WBID 3578) is a Class III freshwater. The designated uses of Class III waters include recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The water quality criteria for protection of Class III waters are established by the State of Florida in the Florida Administrative Code (F.A.C.), Section 62-302.530. The individual criteria should be considered in conjunction with other provisions in water quality standards that apply to all waters, including Section 62-302.500 F.A.C. [Surface Waters: Minimum Criteria, General Criteria], unless alternative or more stringent criteria are specified in F.A.C. Section 62-302.530. In addition, unless otherwise stated, all criteria express the maximum not to be exceeded at any time. The specific criteria addressed in this TMDL document are provided in the following section.

Fecal Coliform Bacteria (Class III Waters- Fresh and Marine)

The most probable number (MPN) or membrane filter (MF) counts per 100 ml of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

The geometric mean criteria reflect chronic or long-term water quality conditions, whereas the 400 and 800 values reflect acute or short-term conditions. To determine the impairment status of Fivemile Creek, the available data were assessed against both components of the acute criteria. It was not possible to assess against the geometric mean criteria due to insufficient fecal coliform data. The 400 MPN/100ml criterion was selected as the TMDL endpoint, since this resulted in a more stringent reduction.

5. FECAL COLIFORM TMDL

This section of the report details the development of the fecal coliform TMDL. Fecal coliform bacteria are frequently used as indicators of fecal contamination since they are abundant in the intestines and feces of animals and people.

5.1 WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET

FDEP maintains ambient monitoring stations throughout the Santa Fe River basin. All data collected at monitoring stations within WBID 3578 were used in the TMDL analysis. However, the dataset for fecal coliforms in Fivemile Creek is rather limited, consisting of only four samples collected between 1995 and 2007 (Table 2). Table 3 provides summary statistics for these fecal coliform data, which are also plotted in Figure 3. The data record reveals no excursions above the 800 MPN/100 ml instantaneous criterion. However, one sample was above the 400 MPN/100 ml criterion that should not be exceeded in more than 10 percent of measurements. Since the entire dataset consists of only 4 data points, this creates an exceedance rate of 25 percent of the measured samples. While one sample exceeding 400 MPN/100 ml is not definitive evidence that Fivemile

Creek is impaired due to pathogens, it is also insufficient to show that such impairment does not exist, especially considering the presence of potential pathogen sources within the watershed. Due to the Consent Decree requirements, EPA is proposing this TMDL for fecal coliform bacteria at this time. It is strongly recommended that additional fecal coliform data be collected in WBID 3578 in order to better evaluate its impairment status and determine necessary pollutant reductions.

Table 2. Monitoring Stations used in the development of the fecal coliform TMDL.

Station ID	Station Name	Available Sampling Period	Number of Samples
21FLA 21030301	Fivemile Creek at CR 239A	1995-1999	3
21FLBRA 3578-A	3578- Bridge on 63 rd Drive	2007	1

Table 3. Water Quality Statistics for Fecal Coliforms in Fivemile Creek (WBID 3578).

Number of Samples	Minimum Concentration (MPN/100ml)	Maximum Concentration (MPN/100ml)	Mean Concentration (MPN/100ml)	Standard Deviation (MPN/100ml)	Water Quality Criteria ^{1,2} (MPN/100ml)
4	17	470	144	219	400 ² , 800

Notes:

1. Geometric mean was not evaluated, since fewer than 10 samples were collected in any 30-day period.
2. The 400 MPN/100 ml criterion may be exceeded in up to 10 percent of samples.

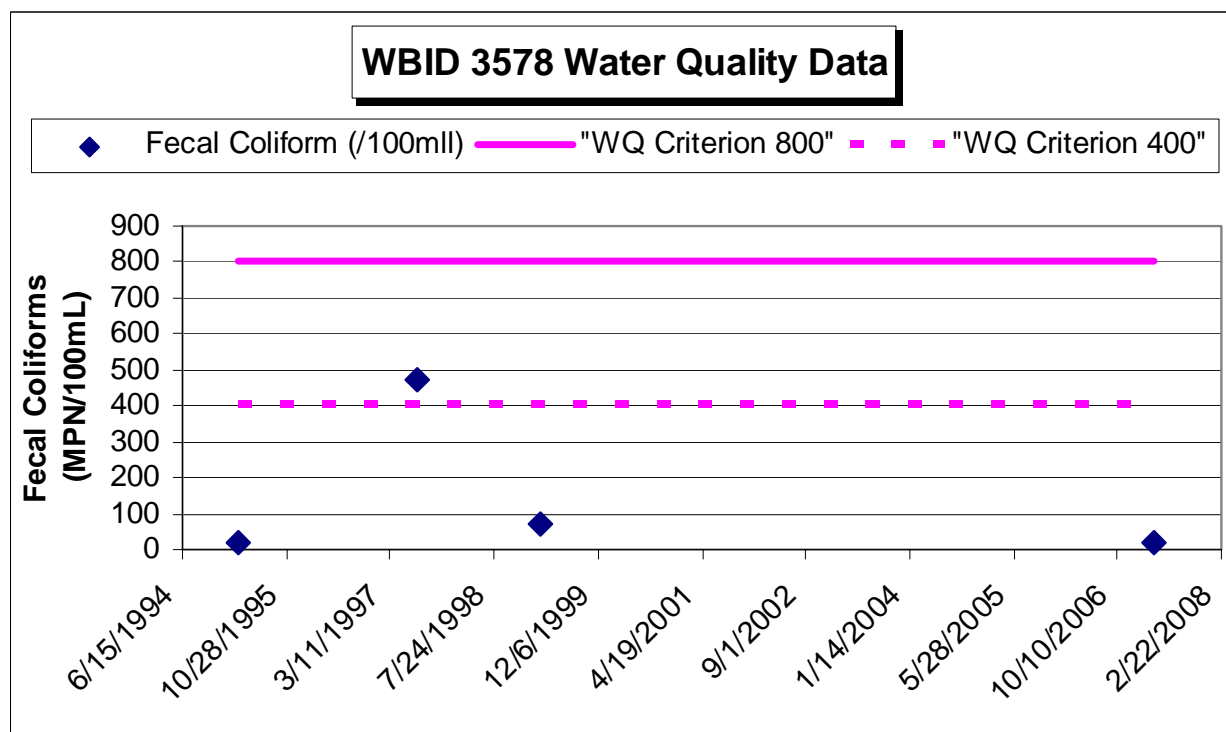


Figure 3. Fecal coliform data collected in Fivemile Creek (WBID 3578).

In order to identify the environmental conditions under which each sample was collected, precipitation totals measured on the dates of each sampling, and for two days prior to each sampling, were obtained. The National Oceanic and Atmospheric Administration (NOAA) collects meteorological data at numerous locations in Florida. Table 4 compares rainfall data from the Gainesville Regional Airport against the fecal coliform concentrations measured in Fivemile Creek. Because a precipitation total measured on the sampling dates may include rain that fell after the water quality sample was collected, rainfall amounts from the two days prior to sampling were also compared. The data suggest that the excursion could have occurred in response to rainfall received the previous day or two before sampling. However, with such a limited dataset it is difficult to make definitive conclusions about the environmental conditions that would cause pathogen impairment in the Fivemile Creek watershed.

Table 4. Rainfall Totals Measured at the Gainesville Regional Airport.

Dates of Fecal Coliform Data Collection	Measured Fecal Coliform Concentration (MPN/100mL)	Rainfall Measured on the Sampling Date (inches)	Rainfall Measured the Previous Day (inches)	Rainfall Measured Two Days Prior (inches)	Total Rainfall Measured on Previous Two Days (inches)
3/15/1995	20	0.09	0.00	0.00	0.00
7/22/1997	470	0.00	0.68	0.22	0.90
3/2/1999	70	0.00	0.00	0.61	0.61
3/30/2007	17	0.06	0.00	0.00	0.00

NOTES: The 1999 and 2007 rainfall data for the Gainesville Regional Airport were obtained from NOAA. The 1995 and 1997 rainfall totals at the Gainesville Regional Airport were obtained from the Weather Underground website (<http://www.wunderground.com/US/FL/Gainesville/KGNV/>).

5.2 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of source categories, source subcategories, or individual sources of coliform bacteria in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either point sources or nonpoint sources.

A point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. Point source discharges of industrial wastewater and treated sanitary wastewater must be authorized by National Pollutant Discharge Elimination System (NPDES) permits. NPDES permitted facilities, as well as certain urban stormwater discharges such as Municipal Separate Storm Sewer Systems (MS4) areas, some industrial facilities, and

construction sites over one acre, are considered primary point sources of coliform bacteria. Typically, excursions of fecal coliform bacteria that occur during periods of reduced rainfall result from a lack of dilution for point source discharges or other sources located close to the waterbody.

Nonpoint sources of coliform are diffuse sources that cannot be identified as entering a waterbody through a discrete conveyance at a single location. These sources generally, but not always, involve accumulation of bacteria on land surfaces and wash off as a result of storm events. Typical nonpoint sources of coliform bacteria include:

- Wildlife
- Agricultural animals
- Onsite Sewer Treatment and Disposal Systems (septic tanks)
- Urban development (outside of Phase I or II MS4 permitted areas)

5.2.1 Point Sources

5.2.1.1 Permitted Facilities

A TMDL wasteload allocation (WLA) is given to NPDES permitted facilities discharging to surface waters within an impaired watershed. Facilities that dispose of wastewater by means other than a surface water discharge, such as spray irrigation or underground injection wells, typically treat wastewater to less stringent secondary standards. These facilities would be considered in the load allocation for nonpoint sources. There are no NPDES facilities permitted to discharge to Fivemile Creek or its upstream tributaries.

5.2.1.2 Municipal Separate Storm Sewer Systems Permits

The 1987 amendments to the Clean Water Act designated certain stormwater discharges as point sources requiring NPDES stormwater permits. The regulated activities involve Municipal Separate Storm Sewer Systems (MS4s), construction sites over one acre, and specific industrial operations. Although these types of stormwater discharges are now considered point sources with respect to permitting and TMDLs, they behave similarly to nonpoint sources in that they are driven by rainfall-runoff processes leading to the intermittent discharge of pollutants from land use activities in response to storms.

According to 40 CFR 122.26(b)(8), an MS4 is defined as “a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains):

- (i) Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law)...including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges into waters of the United States.

- (ii) Designed or used for collecting or conveying storm water;
- (iii) Which is not a combined sewer; and
- (iv) Which is not part of a Publicly Owned Treatment Works.”

In 1990, USEPA developed rules establishing Phase I of the NPDES stormwater program, designed to prevent harmful pollutants that are washed into MS4s by stormwater runoff, or dumped directly into them, from being delivered to local waterbodies. Phase I of the program required operators of “medium” and “large” MS4s (those generally serving populations of 100,000 or greater) to implement a stormwater management program as a means of controlling polluted discharges. Approved stormwater management programs for medium and large MS4s are required to address a variety of water quality related issues including roadway runoff management, municipal owned operations, and hazardous waste treatment, etc. Because the master drainage systems of most local governments in Florida are interconnected, EPA implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities, Chapter 298 urban water control districts, and the Florida DOT throughout the fifteen counties meeting the population criteria.

Phase II of the NPDES stormwater rule extended coverage to certain “small” MS4s and to construction sites between one and five acres. Small MS4s are defined as any municipal stormwater collection system that does not meet the criteria of a medium or large MS4 covered by Phase I. Only a select subset of small MS4s requires an NPDES stormwater permit. These “regulated small MS4s” include those located in “urbanized areas” as defined by the Bureau of Census, and other small MS4s designated by NPDES permitting authorities.

In October 2000, US EPA authorized FDEP to implement the NPDES stormwater program in all areas of Florida except Indian tribal lands. FDEP’s authority to administer the NPDES program is set forth in Section 403.0885, F.S. The three major components of NPDES stormwater regulations are:

- MS4 permits that are issued to entities that own and operate master stormwater systems, primarily local governments. Permittees are required to implement comprehensive stormwater management programs designed to reduce the discharge of pollutants from the MS4 to the maximum extent practicable.
- Stormwater Associated with Industrial Activities, which is regulated primarily by a multisector general permit that covers various types of industrial facilities. Regulated industrial facilities must obtain NPDES stormwater permit coverage and implement appropriate pollution prevention techniques to reduce contamination of stormwater.
- Construction activity general permits for projects that ultimately disturb one or more acres of land and which require the implementation of stormwater pollution prevention plans to provide for erosion and sediment control during construction.

Fivemile Creek (WBID 3578) is not currently affected by an MS4 permit. If areas within the WBID experience population growth to the extent of meeting the MS4 coverage criteria, they may be subsequently designated as a regulated Phase II MS4 by the state of Florida in accordance with Rule 62-620.800, F.A.C. Any newly designated Phase II MS4s will also be required to achieve the percent reduction allocation presented in this TMDL.

5.2.2 Nonpoint Sources

5.2.2.1 Agricultural Animals

Agricultural animals are a potential source of several types of coliform delivery to streams, including runoff from pastureland and direct animal access to streams. About one quarter of the area in WBID 3578 is used for agriculture, with 18 percent classified as improved pasture. Improved pastures are grazing lands where the native vegetation has been replaced with non-native species. Improved pastures may receive varying degrees of treatment in an effort to improve the quality of the forage, including clearing, draining, tilling, fertilizing and re-seeding.

The USDA National Agricultural Statistics Service (NASS) compiles Census of Agriculture data by county for virtually every facet of U.S. agriculture (USDA NASS, 2002). The “Census of Agriculture Act of 1997” (Title 7, United States Code, Section 2204g) directs the Secretary of Agriculture to conduct an agricultural census on a 5-year cycle, collecting data for the years ending in 2 and 7. According to 2002 Census of Agriculture data, there were 13 farms which fertilized approximately 605 acres with manure in Union County, Florida. Livestock counts of cattle and pigs in Union County, FL are provided in Table 5. Because agricultural census data are collected at the county level, the extent to which these values pertain to agricultural fields within the Fivemile Creek watershed is not specified. Landuse data and aerial coverage of the watershed show that most of the stream has a buffer of forest or wetland, and the area in the vicinity of the sampling station is forest (Figure 2). However, agricultural animals could be a relevant source of potential pathogen loading to Fivemile Creek.

Table 5. 2002 Agricultural Census Data for Livestock in Union County, FL.

Livestock	Number of Farms	Number of Animals
Cattle and Calves	207	8,919
Hogs and Pigs	8	295

Note: 1. A farm is defined as any place from which \$1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year.

5.2.2.2 Wildlife

Wildlife contribute coliform bacteria by depositing feces onto land surfaces where it can be transported to nearby streams during storm events. Bacteria originating from local wildlife are generally considered to represent natural background concentrations. In most impaired watersheds, the contribution from wildlife is small relative to the load from urban and agricultural areas.

5.2.2.3 Onsite Sewerage Treatment and Disposal Systems (Septic Tanks)

Onsite sewage treatment and disposal systems (OSTDs), including septic tanks, are commonly used where providing sewer systems access is not cost effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDs are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTD is comparable to secondarily treated wastewater from a sewage treatment plant. When not functioning properly, OSTDs can be a source of nutrients, pathogens, and other pollutants to both ground water and surface water. Since the residential developments within the Fivemile Creek watershed are low density, and comprise less than 6 percent of the total area, they are not expected to be the primary source of fecal coliform bacteria. However, landuse data show that there is some residential development near Fivemile Creek not far upstream of the sampling location (Figure 2). Failure of septic tanks is a possible source of fecal coliforms in the watershed.

5.2.2.4 Urban Development

Urban land uses include residential, industrial, extractive and commercial categories. Fecal coliform loading from urban areas (whether within an MS4 jurisdiction or not) is attributable to multiple sources including storm water runoff, leaks and overflows from sanitary sewer systems, illicit discharges of sanitary waste, runoff from improper disposal of waste materials, leaking septic systems, and domestic animals.

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as outlined in Chapter 403 of the Florida Statutes (F.S.), was established as a technology-based program that relies upon the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C.

Florida's stormwater program is unique in having a performance standard for older stormwater systems that were built before the implementation of the Stormwater Rule in 1982. This rule states: "the pollutant loading from older stormwater management systems shall be reduced as needed to restore or maintain the beneficial uses of water" (Section 62-40-.432 (5) (c), F.A.C.).

In 1994, state legislation created the Environmental Resource Permitting program to consolidate stormwater quantity, stormwater quality, and wetlands protection into a single permit. Presently, the majority of environmental resource permits are issued by the state's water management districts,

although DEP continues to issue permits for specific projects.

Nonstructural and structural BMPs are an integral part of Florida's stormwater programs. Nonstructural BMPs, often referred to as "source controls", are those that can be used to prevent the generation of NPS pollutants or to limit their transport off-site. Typical nonstructural BMPs include public education, land use management, preservation of wetlands and floodplains, and minimizing impervious surfaces. Technology-based structural BMPs are used to mitigate the increased stormwater peak discharge rate, volume, and pollutant loadings that accompany urbanization.

There are few urban areas, and no MS4s, within the Fivemile Creek watershed. As such, the loading contribution of fecal coliform bacteria from urban stormwater runoff is expected to be minimal.

5.3 Analytical Approach

The approach for calculating fecal coliform TMDLs depends on the number of water quality samples and the availability of flow data. When long-term records of fecal coliform concentrations and streamflow data are not available, TMDLs are frequently expressed as the percent reduction from the existing concentration required to meet the TMDL target. Load duration curves may be used to develop TMDLs when sufficient data are available to develop a relationship between flow and concentration. Due to the limited dataset and lack of flow data for WBID 3578, a percent reduction approach was used to express the fecal coliform TMDL. The dataset shows no values above the instantaneous 800 MPN/100 ml criterion, so the percent reduction is calculated to meet the 400 MPN/100 ml acute criterion.

Since the water quality standard for fecal coliform bacteria states that up to 10 percent of samples are allowed to exceed a concentration of 400 MPN/100ml, the existing condition of the waterbody is frequently represented using the 90th percentile of all measured concentrations. The 90th percentile concentration implies that 90 percent of the measured values are lower than this concentration, and 10 percent are higher. Since there are only four fecal coliform datapoints for WBID 3578, calculating a 90th percentile of the samples is problematic. In this TMDL calculation, the existing concentration will be represented by the maximum measured concentration of fecal coliforms, as this provides an implicit Margin of Safety for the TMDL.

The percent reduction required to meet the TMDL endpoint is based on the following equation:

$$\text{Percent Reduction (\%)} = \frac{(\text{existing concentration} - \text{criteria concentration})}{\text{existing concentration}} * 100$$

5.4 Development of Total Maximum Daily Loads

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be represented as the sum of all point source loads (Waste Load Allocation), nonpoint source loads (Load Allocation), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \Sigma \text{WLAs} + \Sigma \text{LAs} + \text{MOS}$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time (e.g. pounds per day), toxicity, or other appropriate measure. The TMDL for Fivemile Creek (WBID 3578) is expressed in terms of a percent reduction.

5.4.1 Critical Conditions and Seasonal Variation

The critical conditions can be defined as the environmental conditions requiring the largest reduction to meet standards. By achieving the reduction for critical conditions, water quality standards should be achieved during all other times. Seasonal variation must also be considered in TMDL development to ensure that water quality standards will be met during all seasons of the year.

The critical condition for nonpoint source coliform loading is typically an extended dry period followed by a rainfall-runoff event. During dry weather periods, coliforms build up on the land surface, and are washed off by subsequent rainfall. The critical condition for point source loading usually occurs during periods of low streamflow when dilution is minimized. A comparison of the fecal coliform concentrations against area precipitation data suggests that the excursion could have occurred in response to rainfall received the day or two prior to sampling. Critical conditions and seasonal variation are accounted for in the TMDL analysis for Fivemile Creek by selecting the largest percent reduction from the entire period of measured water quality data, and using it to represent the pollutant reduction required year-round, for the entire watershed.

5.4.2 Existing Conditions

Existing conditions represent the current water quality conditions of a waterbody. Due to limited fecal coliform data for Fivemile Creek, existing conditions are being conservatively represented using the maximum measured concentration. This method is appropriate, since loads were not calculated due to the lack of streamflow measurements at the sampling times. Fecal coliform concentrations measured in WBID 3578, as well as the maximum concentration and percent reduction required to meet the TMDL target, are shown in Table 6.

Table 6. Fecal Coliform Measurements in Fivemile Creek (WBID 3578)

Date	Time	Depth	Station	Fecal Coliform (MPN/100ml)	Remark Code
3/15/1995	10:10	0.20	21FLA 21030301	20	A
7/22/1997	12:00	0.20	21FLA 21030301	470	
3/2/1999	11:00	1.00	21FLA 21030301	70	
3/30/2007	12:56	0.20	21FLBRA 3578-A	17	
Maximum Fecal Coliform Concentration				470	
Percent Reduction to meet TMDL Target				15%	

NOTES: Remark Code A means that the value reported is a mean of two or more samples

5.5 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: a) implicitly incorporate the MOS using conservative assumptions to develop TMDL allocations; or b) explicitly reserve a portion of the TMDL as the MOS and use the remainder for point and nonpoint source allocations. In the TMDL approach, an implicit MOS was incorporated by using the maximum fecal coliform concentration to represent the existing conditions in the waterbody and to calculate the percent reduction to meet the 400 MPN/100mL criterion, even though up to 10 percent of samples are allowed to exceed the criterion.

5.6. Determination of TMDL, LA and WLA

The TMDL values represent the maximum load the stream can assimilate and still maintain water quality standards. The TMDLs are based on a one-day maximum concentration of the fecal coliforms compared against the 400 MPN/100ml criterion. The TMDL for Fivemile Creek are summarized in Table 7.

Table 7. Summary of TMDL Components for Fivemile Creek (WBID 3578).

WBID	WLA ¹		LA (% Reduction) ²	TMDL (% Reduction) ²
	Facility (MPN/day)	MS4		
Fivemile Creek (WBID 3578)	N/A	N/A	15%	15%

Notes:

1. The WLA is typically separated into the components for continuous NPDES facilities (e.g., WWTPs) and Municipal Separate Storm Sewer (MS4) areas. A Facility WLA is not provided because there are no NPDES facilities currently discharging to surface waters within the Fivemile Creek watershed. WBID 3578 is not currently affected by an MS4 permit, so the WLA for MS4 areas is also not applicable (N/A).
2. Overall percent reduction required to achieve the 400 MPN/100ml fecal coliform criterion. The Margin of Safety is implicit and does not take away from the TMDL value.

The TMDL is expressed as a daily load by multiplying the water quality target by an estimate of flow in the stream. The maximum one day fecal coliform load the stream can transport in any

30-day period while still maintaining water quality standards is calculated by multiplying 400 MPN/100 ml times the flow (in cubic feet per second) and a unit conversion factor to obtain a load of fecal coliform in units of counts per day.

5.6.3. Waste Load Allocation

Only NPDES-permitted facilities discharging directly into streams and MS4-permitted urban areas are assigned a WLA. WLAs are expressed separately for municipal and industrial facilities (e.g., WWTPs) and MS4 areas as the former discharge during all weather conditions whereas the latter discharge in response to storm events.

WBID 3578 is not currently affected by any NPDES or MS4 permits. Any future NPDES facilities located within the watershed will be assigned end-of-pipe discharge limits equal to the state Water Quality Standard for fecal coliforms. Any future MS4s located within the watershed boundaries of WBID 3578 will be prescribed a WLA based on the percent reduction required in the TMDL.

5.6.4. Load Allocation

There are two modes of transport for nonpoint source loading of fecal coliform bacteria into the stream. Direct loadings, such as failing septic systems and animals accessing the stream, are independent of precipitation events. The second mode of transport involves accumulation of bacteria on land surfaces and subsequent delivery to the stream during storm events.

The load allocation for Fivemile Creek is expressed as the percent reduction required for the existing fecal coliform conditions to meet the water quality target. Since there are no point source permits in the watershed, and the MOS is implicit, the percent reduction assigned to the Load Allocation is equal to the TMDL.

5.8. Recommendations

It is strongly recommended that additional data be collected to better assess the contribution of potential sources, the timing of any water quality exceedances, and necessary reductions.

The initial step in implementing a pathogen TMDL is to more specifically locate source(s) of bacteria in the watershed. FDEP employs the Basin Management Action Plan (B-MAP) as the mechanism for developing strategies to accomplish the specified load reductions. Components of a B-MAP are:

- Allocations among stakeholders
- Listing of specific activities to achieve reductions
- Project initiation and completion timeliness
- Identification of funding opportunities
- Agreements

- Local ordinances
- Local water quality standards and permits
- Follow-up monitoring

REFERENCES

Florida Administrative Code (F.A.C.). Chapter 62-40 Water Resource Implementation Rule.

Florida Administrative Code (F.A.C.). Chapter 62-302 Surface Water Quality Standards.

Florida Administrative Code (F.A.C.). Chapter 62-303 Identification of Impaired Surface Waters Rule (IWR).

Florida Administrative Code (F.A.C.). Chapter 62-620 Wastewater Facilities and Activities Permitting.

USDA NASS, 2002. *2002 Census of Agriculture, Volume 1, Geographic Area Series, Part 9*, U.S. Department of Agriculture, National Agricultural Statistics Service. AC02-A-9, June 2004.

USEPA, 1991. *Guidance for Water Quality –based Decisions: The TMDL Process*. U.S. Environmental Protection Agency, Office of Water, Washington, DC. EPA-440/4-91-001, April 1991.